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A Sempra Energy® company

December 2, 2002

Mr. Bill Pennington
California Energy Commission
1516 9th Street
Sacramento, CA 95814-5512

Re: Gas Cooling Code Change Proposal

Dear Bill:

Sempra Energy Utilities (SEU) – Southern California Gas Company and San Diego Gas and Electric has received a copy of the letter dated October 21, 2002 from Gregg Ander of Southern California Edison to your office in which Edison offers comments of our code change proposal. SEU has conducted a careful review of Edison's letter and we would like to offer our responses. Edison's comments are repeated below, and SEU's responses follow in underlined text.

Comment 1 - Page 2, Par. 1:

> Since most of the power plants in California are gas fired, it is not clear if the peak natural gas demand prices may change from winter to summer in the future. Are there any credible forecasts for gas demand projections and costs that could be implemented in a benefit cost analysis?
>
> <u>This question relates to the rules for applying time-dependent valuation and cost-benefit analysis that have already been established. It is not in our purview to reevaluate these rules, particularly since they affect all compliance measures to which TDV is applied. Furthermore, these incremental changes to the Standard with respect to natural gas cooling should not significantly alter the space cooling market. Current market share of natural gas cooling equipment is less than 1% of the new construction market. This is unlikely to change with the implementation of the proposed energy standards. Therefore natural gas demand prices will continue to be higher in winter than in summer.</u>

Comment 2 - Page 3, Par. 4:

> The report describes the benefits of gas cooling under special conditions, however it does not disclose characteristics, which may impact the benefit

cost analysis for engine driven and direct-fired absorption chillers. This hardware requires separate chiller rooms from electric chillers, and the footprint is much larger than traditional electric chillers. The additional space and fire rated walls, which are required pursuant to the Universal Mechanical Code (UMC) Section 1106.7 should be factored into the benefit cost analysis. Additionally, the first cost of gas driven chillers and absorption chillers is much higher and these costs should also be reflected.

<u>It is recognized that gas-cooling systems are typically more expensive than their electric counterparts, which is why they have a smaller market share. Additional space and firewalls required by the UMC do not apply to engine-driven chillers and to indirect fired absorption chillers. Modern gas engine driven chillers with their top mounted compressor drivelines typically require a similar machine room footprint as their electrical counterparts. In addition, there may actually be cost savings associated with gas cooling such as smaller electric switchgear, reduced electric feeder sizes, no compressor VFD, lower utility electric line extension costs, reduced transformer costs and reduced emergency generator requirements. However, the overall cost differences will depend on size of plant and its configuration, which is very site specific. See response to Comment 8 below regarding cost-benefit analysis.</u>

For a gas absorption chiller, the lower limit of the chilled water temperature is higher than the electric chiller. For this reason, absorption chillers cannot be applied to systems that require low temperature chilled water. Absorption chillers cannot take advantage of lower condenser water temperatures; typically absorption chillers operate at temperatures in the high 70's degree condenser water temperature range. If the condenser water temperature drops too low, the bromide solution will crystallize and destroy the chiller. In this case, absorption chillers are less efficient, as more heat has to be rejected to the outdoors. Also, these systems require larger cooling towers, condenser water piping, and condenser water pumps. All of these will increase the first cost of the cooling system and should be included in the economic analysis.

<u>This is a design and application issue, not a standards issue. An argument can be made that designers should consider non-mechanical cooling alternatives (such as dry or wet side economizing) when ambient temperatures fall low enough to create the condition noted above. Modeling methods for absorption cooling already exist and are described in the 2001 Non-residential ACM Manual. We have not reviewed the DOE-2 engineering model for absorption cooling, but assume that it correctly considers chilled water temperature, cooling tower sizing, and other design parameters that affect performance. Potential for crystallization has been virtually eliminated as a result of modern microprocessor based, high response, interactive chiller controls. Many</u>

risks related to improper application of electric chillers could be pointed out; proper engineering, start-up and operation are required regardless of the chiller type. See response to Comment 8 regarding economic analysis.

Comment 3 - Page 5, Par. 3:

The report did not point out that it takes much longer to perform a major overhaul of a gas engine. This will affect the operation of the building and should be reflected in the O&M section of the economic analysis.

Major overhauls for engines are generally done as part of scheduled maintenance and can be planned during periods of low cooling demand. In addition, the on-site overhaul of any mechanical chiller, including electric machines is generally of the same duration. Prime movers are overhauled concurrently and would not substantially change the availability of either type of machine. Design engineers and facility managers typically make allowance for equipment downtime for maintenance through redundancy (e.g. multiple chillers) or other means. See response to Comment 8 regarding economic analysis.

Comment 4 - Page 5, Par 6:

In order to accurately access the cost effectiveness, life cycle analysis must be performed for various building types in various climatic zones.

The minimum energy efficiency requirements for absorption chillers were taken from the tables in the ASHRAE 90.1 standards, as were the electric chillers. The Commission adopted the ASHRAE standards during the AB970 Emergency Regulations. This proposal adds to those standards by including residential gas cooling standard and a standard for engine driven equipment. Since this is a compliance options proposal, no cost benefit analysis is required. See response to Comment 8 regarding economic analysis.

Comment 5 - Page 8, Par. 5:

There are limited sizes of absorption chillers available for residential applications. It may not be true that the next highest half-ton chiller over the highest hourly load will be available. One should select the next available chiller size over the designed peak-cooling load.

This is a sizing issue, not a standards or compliance issue. Performance degradation due to part load (and over-sizing) is accounted for in the proposed ACM equations (see p. 10 of the Code Change Proposal). This produces a more conservative estimate of energy use than is proposed for electric air conditioners, for which the proposed ACM uses the SEER rating to reflect part load.

Comment 6 - Page 9, Equation 1

The capacity of an absorption chiller is a function of the chilled water temperature and the condenser water temperature (for water cooled), or the chilled water temperature and the outdoor dry bulb temperature (for air cooled). It should not be just a function of outdoor dry bulb temperature alone.

<u>The referenced equations only apply to residential systems where modeling assumptions are simplified. The basis of calculation of cooling capacity for gas cooling is not very different from electric cooling. The proposed residential ACM for both air-cooled and water-cooled electric air conditioners also applies only outdoor dry-bulb temperature in calculating capacity. In the gas-cooling algorithm, the chilled water temperatures are assumed to be constant, just as the refrigerant temperature in the evaporator is assumed to be constant in electric DX systems. Finally, operational and size limitations due to fluctuations in capacity exist for all equipment and it should not be a reason for penalizing them in the standards. Both types of cooling equipment are similarly affected by these conditions.</u>

Comment 7 - Page 9, Equation 3:

The performance of an absorption chiller is a function of the chilled water temperature and the condenser water temperature (for water cooled), or the chilled water temperature and the outdoor dry bulb temperature (for air cooled). It should not be just a function of the outdoor dry bulb temperature alone.

<u>The response to Comment 6 applies also to this comment.</u>

Comment 8 - Page 15, Recommendations:

Any Energy Codes and Standards changes require being cost effective through life cycle cost analysis. No life cycle cost analyses has been conducted for the study. Only compliance margins on energy have been presented.

<u>The only proposed standards change is to list gas engine driven chillers and heat pumps in the tables. Gas engine-driven equipment is already permitted by the standards but there are no minimum performance criteria established. Other changes relate to additions or improvements to the ACM Manual. Code change proposals for compliance options are not required to prove they are cost-effective; gas cooling is a compliance option.</u>

Comment 9 - Page 19, Equation 3.1gc:

See comment for Page 9, Equation

<u>The response to Comment 6 also applies to this comment.</u>

Comment 10 - Page 19, Equation 3.4gc:
See comment for Page 9, Equation 3.

The response to Comment 6 also applies to this comment.

We will be pleased to respond to any other comments or concerns on the code change proposal either by telephone or at a public workshop. Please feel free to contact me at your convenience

Sincerely,

Kurt Kaufman

Cc: Gregg Ander, Southern California Edison
Dave Springer, Davis Energy Group
Brian Alcorn, California Energy Commission